Claims

1. A pump comprising:
   a stator;
   at least one rotor mounted within a housing, the housing comprising a first fluid channel extending about the rotor, the rotor comprising at least one second fluid channel;
   a first sensor configured to output a signal indicative of the temperature of the stator;
   a second sensor configured to output a signal indicative of the temperature of the rotor; and
   thermal control means for controlling the temperature of fluid, when present, in said channels depending on the magnitude of signals output from the sensors.

2. A pump according to claim 1, wherein the first temperature sensor is located at the stator.

3. A pump according to claim 1 or claim 2, wherein the second temperature sensor is located in the gear box.

4. A pump according to claim 1 or claim 2, wherein the second temperature sensor is located in the housing, in fluid contact, in use, with process gas in an exhaust portion of the rotor.

5. A pump according to any preceding claim, wherein the thermal control means comprises:
   first control means for controlling the temperature of fluid in the first fluid channel; and
   second control means for controlling the temperature of fluid in said at least one second fluid channel.

6. A pump according to claim 5, wherein the first control means comprises:
   at least one flow pump;
   at least one control valve; and
   at least one heat exchanger.

7. A pump according to claim 5 or claim 6, wherein the first control means is arranged to control the temperature of fluid in the first fluid channel depending on the magnitude of a signal output from the first sensor.

8. A pump according to any of claims 5 to 7, wherein the second control means comprises:
   at least one flow pump;
   at least one control valve; and
   at least one heat exchanger.

9. A pump according to any of claims 5 to 8, wherein the second control means is arranged to control the temperature of fluid in the at least one second fluid channel depending on the magnitude of a signal output from at least the second sensor.

10. A pump according to any of claims 5 to 9, wherein the second control means is arranged to control the temperature of fluid in the at least one second fluid channel depending on the magnitude of signals output from the second sensor and an additional sensor configured to output a signal indicative of the temperature of the stator.

11. A pump according to any of claims 5 to 9, wherein the second control means is arranged to control the temperature of fluid in the at least one second fluid channel depending on the magnitude of signals output from the first and second sensors.

12. A pump according to any of claims 5 to 11, comprising a microprocessor for controlling at least one of the first and second control means.

13. A pump according to any of claims 5 to 12, comprising a microprocessor for controlling both the first and the second control means.

14. A pump according to claim 12 or claim 13, comprising a third sensor configured to output to the microprocessor a signal indicative of one of the group of pressure and power consumption of the pump, wherein microprocessor is arranged to control at least the second control means depending on the magnitude of that signal.

15. A pump according to any of claims 9 to 12 when dependent from claim 8, wherein said at least one control valve of the second control means comprises a mechanical differential temperature valve.

16. A pump according to claim 15, wherein the mechanical valve comprises
a third fluid channel in thermal communication with the at least one second fluid channel;
a flow restrictor moveable within the third fluid channel to control the rate of flow of a fluid therethrough; and
two signal receptors for receiving signals from the first and second sensors respectively and controlling the position of the flow restrictor within the third fluid channel depending on the magnitude of the signals received from the first and second sensors.

17. A pump according to claim 16, wherein each signal receptor comprises a sealed component, a volume of each component expanding, in use, depending upon the magnitude of the signal received, thereby to control the relative position of the restrictor within the third fluid channel.

18. A pump according to claim 17, wherein each signal receptor comprises an expandable bellows.

19. A pump according to any of claims 16 to 18, wherein the flow restrictor comprises:
a spindle; and
a seat, the spindle acting cooperatively with the seat to open and close an aperture to control the flow of fluid therethrough, in use.

20. A pump according to any preceding claim, wherein the pump is one of the group of a screw pump, a claw pump and a Roots pump.

21. A pump according to any preceding claim, wherein the housing comprises an inner skin and an outer skin, a first cavity being formed by the inner skin, the rotor being mounted therein, the first fluid channel being formed between the inner and outer skins of the housing and extending the length of, and encircling, the rotor.

22. A pump according to claim 21, wherein the inner skin of the housing provides the stator, in use.

23. A double-ended pump comprising:

at least one rotor, comprising one inlet portion and two exhaust portions;

a stator; and

a housing, the housing comprising an inner skin and an outer skin, a first cavity being formed by the inner skin, the rotor being mounted therein and a second cavity being formed between the inner and outer skins of the housing through which a fluid is circulated, in use, wherein the second cavity extends the length of and encircles the rotor.

24. A valve comprising:

a fluid channel;

a flow restrictor moveable within the fluid channel to control the rate of flow of a fluid therethrough; and

two signal receptors for receiving respective signals and controlling the position of the flow restrictor within the channel depending on the magnitude of the received signals.

25. A method for releasing the rotors of a pump that have seized due to the presence of deposits of a substance which has formed on the internal working surfaces of the pump on cooling, comprising the steps of:

introducing a thermal fluid into a cavity provided within the housing of the pump, the cavity encircling the rotor components;

heating the thermal fluid in the cavity to a predetermined temperature, this temperature being sufficiently high to cause the deposits to be softened; and

applying torque to the rotors of the pump to overcome any remaining impeding force caused by the deposits located on the internal working surfaces of the pump.

26. A method for controlling a clearance between a rotor and stator within a pump according to any of claims 1 to 22, the method comprising the steps of:

(a) recording the temperature of each of the stator and the rotor using the signals output from the sensors;

(b) calculating the temperature difference between the stator and the rotor;

(c) comparing the temperature difference with a predetermined value;

(d) determining suitable values of flow rate and temperature for the fluid in the first and second fluid channels to achieve a predetermined temperature difference; and

(e) controlling the thermal control means to realise the values from step (d).

27. A method according to claim 26, wherein the method steps are automatically repeated at predetermined time intervals to manage perturbations in the configuration of the pump over time.

28. A method according to claim 26 or claim 27, wherein the predetermined temperature difference is modified at predetermined time intervals to cause the clearance between components to be altered such that cumulative deposits can be dislodged from the surfaces of the components of the pump.

29. A computer program which, when installed on a computer, causes the computer to perform the method of claim 26, 27 or 28.

30. A computer readable carrier medium which carries a computer program as claimed in claim 29.

31. A computer readable carrier medium according to claim 30, wherein the medium is selected from; a floppy disk, a CD rom, a mini-disc or digital tape.